Case Report

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Prefabricated Space Maintainers, A Choice Over Conventional Space Maintainers – A Case Report With 2 Year Follow Up

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Abstract

Introduction: *Development of the dentition is a complex process. Any disturbances during this process can initiate space problems. To prevent the dental arch deficiency after untimely loss of primary teeth, a space maintainer is employed. Prefabricated space maintainers were introduced in 1935 but they were popularized only recently. The current article discusses a case report with 2 year follow up using one such prefabricated distal shoe space maintainer. It follows the CARE guidelines developed to write case reports.*

Case Description: *A 4 year old child reported with pain in the lower right back tooth region. Clinical examination revealed a grossly carious right mandibular primary second molar. After assessing the case, an extraction of the tooth followed by a prefabricated distal shoe space maintainer was decided as the treatment of choice. As per the steps described by the manufacturer, the prefabricated distal shoe space maintainer was cemented post-radiographic confirmation. The first permanent molar was seen erupting in the oral cavity in its physiologic position after about 2 years post placement of the space maintainer. The same space maintainer was then modified and used as a reverse band and loop space maintainer.*

Conclusion: *Pre-fabricated space maintainers can be a novel alternative to the conventional fixed space maintainers used in pediatric dentistry.*

Keywords : Distal shoe, Reverse band and loop, Space maintenance.

Introduction

Development of dentition is a long process that occurs in an orderly fashion from primary dentition through the transitional stage into the permanent dentition, resulting in a functional, aesthetic, and stable occlusion (American Academy of Pediatric Dentistry (AAPD), 2023). During this long process, if any disturbances occur, they can prevent the progression to normal occlusion. Every tooth is maintained in its socket over the basal bone in a certain relationship to the dental arch, with adjacent and opposing teeth under a continuous balanced force. One of the most indispensable functions of a primary tooth is to maintain the physiologic space and guide the eruption of the succeeding teeth. Early loss of primary teeth is one of the most common problems during the transitional stage of dentition, resulting in space loss of succeeding teeth (Souror et al., 2019). Numerous authors have concluded that maximum space loss occurs within the first year after premature loss of primary teeth (Northway & Demirjian, 1984; Padma Kumari & Retnakumari, 2006).

According to Morrees, the average arch length of an individual is less at the age of 18 months than at the age of 3 years (Moorrees & Chadha, 1965). Barber believes that our goal should be to prevent loss of arch circumference at any cost no matter how small it is (Bell et al., 2011). To maintain the arch circumference and prevent the malocclusion caused by premature loss of primary teeth, fixed and removable space maintainers are recommended (Deshpande et al., 2018). Several authors have discussed the advantages and disadvantages of conventional space maintainers; however, the disadvantages outweigh the advantages (Tahririan et al., 2019; Deshpande et al., 2018; Eshghi et al., 2018; Mittal et al., 2018).

Prefabricated space maintainers were introduced in 1935 but were recently popularized (Ricketts, 1976). Prefabricated space maintainers can be done in a single appointment, are precise and easy to fabricate, save lab costs, and are less time consuming. According to Setia et al., prefabricated space maintainers are more rational and cost-effective than the conventional ones in relation to gum health as well as dental office work (Setia et al., 2014). The current article discusses a case report using one such prefabricated distal shoe space maintainer which can later be modified into a reverse band and loop space maintainer.

Case Report

A 4 year old male child patient visited a private clinic with a chief complaint of pain and swelling in the lower right back tooth region. The pain was throbbing and intermittent in nature. Patient had no relevant medical history. The clinical examination revealed that the right mandibular primary first molar had deep carious lesion and second primary molar was grossly carious. There was dentoalveolar abscess associated with respect to the second primary molar. Radiographic examination revealed intrafurcal radiolucency involving the crypt of the succeeding tooth bud along with resorption of 1/3rd of its roots and hence extraction was planned as the treatment of choice for second primary molar (Figure 1,2).

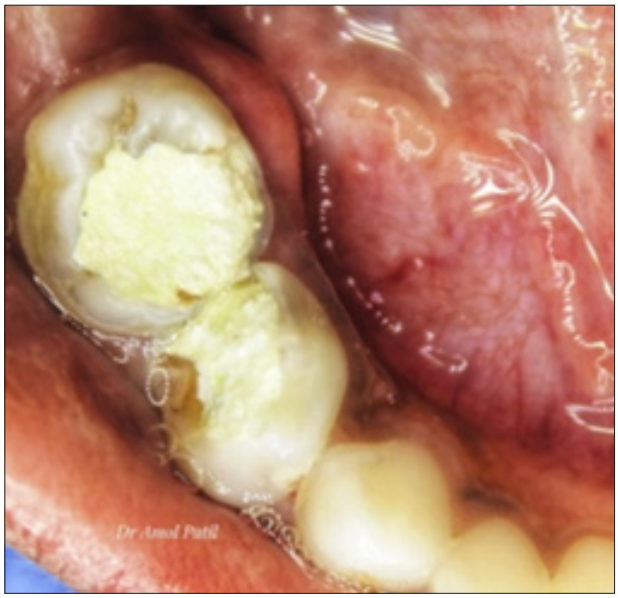

Figure 1: Pre-operative clinical picture showing 84 and 85.

Figure 2: Pre-operative radiograph showing 84, 85 and erupting 46.

The first primary molar revealed caries involving the pulp on radiographic examination and therefore pulp therapy followed by stainless steel crown was decided as the treatment of choice. As the first permanent molar hadn't erupted at the time of examination, a distal shoe space maintainer was decided to be placed post extraction. During the first appointment, pulpectomy followed by stainless steel crown was done for the first primary molar.

The second appointment consisted of extraction of second primary molar and immediate placement of a preformed distal shoe e-space maintainer by 'Kids-e-Dental' LLP, INDIA.

As per the steps mentioned by the manufacturer a prefabricated band was selected from the kit by measuring the mesio-distal diameter of the abutment tooth with a vernier caliper. It was ensured that it covered the entire surface of the tooth and was fitting tightly. A band pusher was used to adapt the band on the tooth. A distal shoe loop was then selected and its length was adjusted and marked according to the mesio-distal dimension of the extraction space. The horizontal and vertical width of the distal shoe space maintainer was measured by tracing the x-ray film on butter paper and then confirmed intra-orally using a straight probe with a rubber stopper and marked on the space component. It was then cut to the desired length using the special cutter provided in the kit.

The band was then removed from the mouth and the wire was slid in the tube of the band. The band was then placed back on the tooth to check if the space maintainer is fitting properly with the shoe touching to the mesial marginal ridge of the erupted 46 in a passive manner. An intra oral crimper was then used to crimp the tube in the center which cold welded the tube and the space component. The components were crimped once again after removing the band and space component to completely join the tube and space component. After radiographic confirmation cementation was done using the luting cement GC Fuji Type I (Tokyo, Japan) (Figure 3, 4).

Figure 3: Immediate post operative clinical picture with distal shoe space maintainer.

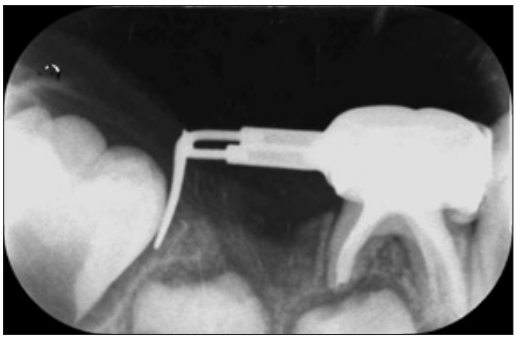

Figure 4: Immediate post operative radiograph with distal shoe space maintainer.

The parents were given post cementation instructions after the treatment was completed. The patient was recalled after every 6 months for follow up (Figure 5, 6).

Figure 5: 12 month post operative clinical picture with distal shoe space maintainer.

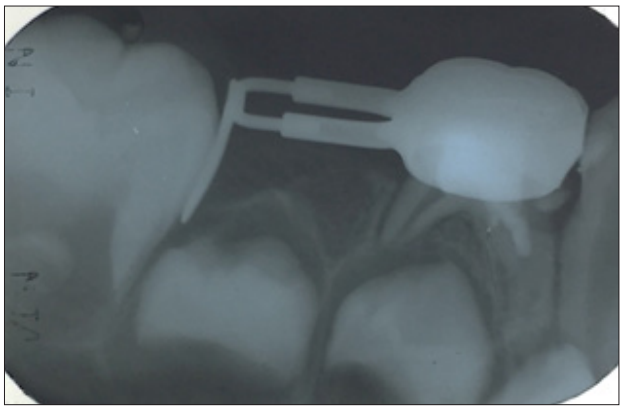

Figure 6: 12 month post operative radiograph with distal shoe space maintainer

The first permanent molar was seen erupting in the oral cavity in its physiologic position after about 2 years post placement of the space maintainer. The same space maintainer was then modified and used as a reverse band and loop space maintainer eliminating the need of fabrication of an additional space maintainer (Figure 7, 8,9).

Figure 7: 24 month follow up image showing eruption of 46.

Figure 8: Modification of distal shoe space maintainer into reverse band and loop space maintainer post eruption of 46- 24 month follow up

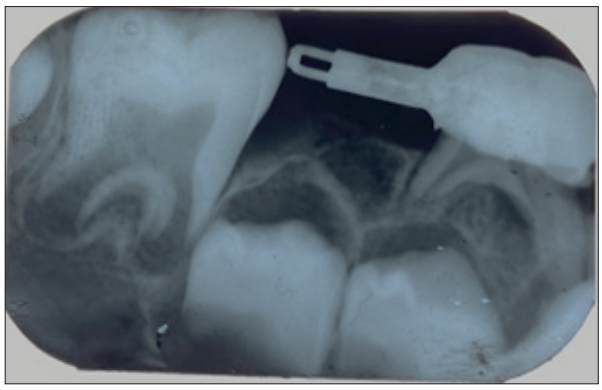

Figure 9: Radiograph showing distal shoe space maintainer converted into reverse band and loop space maintainer post eruption of 46- 24 month follow up.

Discussion

Amongst the other functions, the primary dentition helps to provide a successful transition into the permanent dentition by preserving arch integrity and directing the eruption of their successor teeth. They also operate as a natural space maintainer (Achmad, 2021). According to Tunison et al, there is an immediate space loss of 1.5 mm in the mandible and 1 mm in the maxilla when a primary molar is lost prematurely (Tunison et al., 2008). According to Northway et al., more space is lost in the first year of extraction than in the subsequent years (Northway & Demirjian, 1984). According to Kumari et al., most space closure happens during the first four months after the extraction (Padma Kumari & Retnakumari, 2006). Therefore, when primary teeth are lost prematurely, space maintainers are used to prevent space loss (Achmad, 2021). The space maintainer appliance is chosen based on a variety of considerations, including the child's dental developmental stage, the dental arch involved, the tooth missing, the state of the teeth adjacent to the lost tooth and the eruption status of the succedaneous permanent teeth.

The success of space maintainers is measured using a variety of metrics. The longevity of space maintainers, gingival health, plaque accumulation, the state of the abutment tooth, and the simplicity with which the appliance is made are all factors to consider. Their endurance and capacity to preserve space, which is their principal role, are the most crucial (Souror et al., 2019).

Conventional band and loop space maintainers have good patient compliance and high success rates. However, several drawbacks such as cement disintegration, solder failure, development of caries along the band's edges, inability to prevent the neighbouring teeth from rotating or tilting, and extra chairside and laboratory time make it a time-consuming operation (Mittal et al., 2018).

According to Sami Malik et al., loop fracture, solder failure, and cement dissolution, were the most prevalent causes of a broken conventional band and loop space maintainer over a 12-month period (Sami Maliket al., 2014). According to Kargul et al., traditional band and loop space maintainer manufacturing required additional laboratory time and a minimum of two visits which was time consuming, laborious, and expensive (Kargul et al., 2005).

According to Qudeimat et al., the most prevalent cause of band and loop fracture is cement and solder fracture (Qudeimat & Fayle, 1998). Solder failures might be the result of an inadequate solder connection. Another research by Rajab et al., found that the most prevalent cause of failure was solder fracture, with cement loss coming in second (Rajab, 2002). This drawback can be avoided with the pre-fabricated space maintainer as there is no soldering involved.

Gingivitis is another reason for traditional space maintainer failure. In comparison to the usual type, prefabricated band and loops demonstrated excellent levels of gum health according to has to be deleted. This implies that the prefabricated type is more compatible with the gingiva and therefore, will cause less inflammation in the gingival tissue.

Bonded space maintainers are a type of space maintainers which and the number of visits required, leading to faster fabrication, better gingival health and less cost. However, they were difficult to retain due to shearing forces of occlusion, plus flexure in function de-bonded the space maintainer and were also difficult to adjust.

In light of the aforementioned drawbacks, this paper discusses a unique prefabricated 'e-space maintainer' that is simple and quick to use and avoids the need for several equipment and lengthy processes. From fabrication to delivery, the entire process was accomplished in one appointment with only a few equipment. Welding, soldering, polishing, and finishing were not necessary as part of the laboratory job. Incomplete solder joints, overheating of wire during soldering, breaking of wire at junction during polishing, ill-fitting in the patient's mouth, and failure of cementation, all problems of the traditional space maintainer were avoided by using the pre-fabricated space maintainer.

Conclusion

In conclusion, prefabricated space maintainers, provide a significant advancement in pediatric dentistry, offering a pragmatic and cost-effective solution for preserving dental arch integrity and preventing malocclusion following premature loss of primary teeth. They streamline the process of space maintenance and address the shortcomings of conventional methods making them a valuable option for ensuring functional and aesthetic dental development in children.

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